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Integrated Product Team leads GII 2000 effort

Since the spring of 1996, a small group of scientists and engineers, chartered by the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASDC^{3}I), have been diligently working to devise a new paradigm for how the national security agencies, CINCs and Services, and defense agencies will work together as a community to achieve information dominance.

This community effort is led by an Integrated Product Team (IPT) with participants from stakeholder organizations. The impetus for this effort is founded in a Defense Science Board Report completed during the summer of 1995. This report, titled "Defense Mapping for Future Operations," recommended the Department of Defense do the following:

- Evolve a distributed heterogeneous Internet-like architecture that uses the geospatial data bases as its foundation;
- Change the defense mapping mission to: maintain the geospatial data bases and protect access and integrity;
- Institute a requirements process that prioritizes users' geographic needs;
- Rapidly acquire access to virtual worldwide data bases using all available commercial sources and practices;
- Equip and educate the end user to locally add value and meet his needs; and
- Establish an IPT to manage the whole process.

The IPT is organized to meet the challenge of implementing the Geospatial Information Infrastructure (GII) through the team structure identified below.

The four focus teams that form

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Abstract Since the spring of 1996, a small group of scientists and engineers, chartered by the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASDC 3 I), have been diligently working to devise a new paradigm for how the national security agencies, CINCs and Services, and defense agencies will work together as a community to achieve information dominance.	
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Integrated, *continued from page 1*

the base of the pyramid reflect the functional aspects of requirements collection, production, management and dissemination, and applications. Army is providing leadership for the applications team, termed the "catcher's" mitt by the Defense Science Board, while the National Imagery and Mapping Agency (NIMA) is providing leadership for the other three teams. The remaining teams have responsibilities, which cut across the four basic focus teams.

Also acknowledged in the depiction is the importance of commercial industry to the IPT and the two-way flow of information between the IPT and industry through the OpenGIS Consortium (OGC). This teaming arrangement provides the structure to address all of the areas that must be in place in order to successfully implement the GII. Given the importance of this effort, Army is actively participating on most of the IPT's component teams.

The IPT has been tasked to provide the following deliverables:

- Master Plan for GII 2000 and Beyond—A community-based business and investment strategy for implementation of the business processes, cultural changes and iterative technology insertions needed to develop the GII.
- GII 97—An extendable GII proof-of-concept demonstration capability relying heavily on commercial technologies.

Though not specifically identified as a deliverable, another valuable aspect of the work that the IPT is engaged in is the evolutionary process itself. As identified on Page 3, this includes a partnership between government stakeholders and industry to evolve the infrastructure in a spiral process over time.

The IPT has progressed through two iterations of the Master Plan, the latest of which was published in January. The Master Plan contains two volumes: Volume 1 provides an overview of the GII in a question and answer format, while Volume 2 contains the detailed functional requirements for implementation of the GII. There will be one more iteration of the plan in July, prior to distribution of the final plan in October. The July release of the plan will be the first time that stakeholder organizations will outline their own plans to develop their portion of the GII. These plans will focus on the areas of doctrine, training, organization, and technology acquisition needed to make the GII 2000 a reality. The Army's implementation plan currently is being developed by U.S. Army Training and Doctrine Command's Program Integration Office (TPIO) for Terrain and will be available for review with release of the July draft of the Master Plan.

Editor's note: The "topo logo" or cube is symbolic of the spatial nature of Digital Topographic Data which can be stored, manipulated, analyzed and displayed in 3-D.

Contents

Positive impacts on Army

One of the clearest impacts of successful GII implementation on Army users will be the near-worldwide availability of a thin layer of highly accurate information, which can be used for initial planning, and for integrating and exploiting other battlefield information. This layer, called foundation, consists of elevation information, geopositioned imagery, and vector feature information as shown below.

Plans for acquisition of the three foundation components are well underway and include the following:

- DTED Level 2 - Collect near-worldwide Interferometric Synthetic Aperture Radar (IFSAR) information during a Space Shuttle mission in the 1999 time frame for derivation of Level 2 elevation data.
- Spatial Imagery - Use National Technical Means (NTM) and commercial imagery to produce monoscopic and stereo geopositioned imagery.
- Feature Data - Initial definition of foundation feature data includes transportation, drainage, population, geodetic control and boundaries. Government and commercial production capacity will be used to generate this vector feature

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information to compliment the other foundation components.

The availability of foundation information will be beneficial from a user viewpoint because the GII community will then have a basic set of accurate information to which more detailed information can be added both in the field and at community production facilities. This is an important anticipatory production step given our inability to accurately forecast where the next combat, peacekeeping, or disaster relief mission will occur. In addition to the foundation component, NIMA will produce Mission-Specific Data Sets (MSDS). Mission specific, as used by the IPT, applies broadly to mission space needs and connotes a spectrum of support from operational and contingency plans to specific hardware systems including mission planning, weapons, and command and control systems. These data sets include standard products and standard coverage subsets of standard products as requested by the user.

During normal production, standard products and coverage subsets will be delivered as they are produced in the order specified by the user. For example, a user may request sequenced delivery of the soil, obstacles, and utilities coverages from Digital Topographic Data (DTOP) in order to meet the information requirements for a specific mission. These will be delivered in addition to the foundation information. During crisis production, MSDS may include nonstandard coverages, depending on the timelines for the mission. It is anticipated that initially most users will continue to request standard products since the functionality of application software is often dependent upon the complete information content of a particular product. However, as application software evolves and becomes more flexible, users will request coverage subsets in order to achieve broader geographic coverage.

Next steps

Initial production of foundation data using NIMA's existing production capability already is underway in support of operational and exercise/demonstration needs. Metrics regarding collection times and bottlenecks in the collection process are being captured for later comparison to production using emerging commercial technologies. The first 1-degree cell of foundation currently is nearing completion over the National Training Center. This cell will be released for user evaluation later this spring. Testing of commercial technologies, which will instantiate GII 97 will be initiated in May and continue throughout the summer. Based on this testing, technologies will be recommended for incorporation in GII 97.

More information regarding the Geospatial Information IPT and the full range of activities that it is embarked upon, including interaction with commercial industry through the OGC, is available on the GI IPT home page at http://164.214.2.57. (Jeffrey Messmore, U.S. Army Topographic Engineering Center, CETEC-PD-D, 7701 Telegraph Road, Alexandria, VA 22315-3864, 301-227-5962)

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Clear the way

Army's Topographer explains TPIO-TD concept

Editor's Note: In March 1997, this article, written by Maj. Gen. Clair F. Gill, was first published in *Engineer* magazine as "Clear the Way."

The topographer of the past wore buckskin, had a transit over his shoulder, a worn trig list, a sketch pad in his pouch, and a flintlock rifle in his hand. He opened the wilderness with exploration and mapping. As the military-terrain expert, he assimilated the terrain effects to successfully defeat the enemy. The topographer of the future collects, develops, manages, analyzes, and distributes digital data and products. The analysis and products provide an accurate digital view of the battlefield. They open the new frontier in the digital age, able to assimilate the terrain effects to successfully defeat the enemy. The same functions with different and improved tools to accomplish the task at hand, always the terrain expert.

Photo #1

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95%

Engineers in the Digital Concepts and Analysis Center are providing technical assistance to the TRADOC Program Integration Office for Terrain Data.

Progressing toward Force XXI

Information technology and digitization has revolutionized how the Army trains and fights. Nowhere is this more evident than in the field of terrain information and analysis. As the Army progresses toward Force XXI, there is a steady migration from hard-copy maps and products to digital information and analysis. The digital data directly feeds battle command and fighting systems. With few exceptions, new combat systems have embedded digital terrain requirements that far exceed today's available data. Providing these accurate digital data sets to the force is the responsibility of the engineer. As the Topographer of the Army, I have direct responsibility to see we meet this challenge of the Information Age Frontier.

In the summer of 1996, I was charged by the U.S. Army Training and Doctrine Command (TRADOC) to study the development of terrain data bases within the Army's modeling and simulations (M&S) community. The primary purpose of the study was to develop a process to reduce the duplication of efforts within the M&S community in the production of digital terrain data bases, while increasing the accuracy of the portrayal of the terrain and its effects. We quickly realized that the problems of defining terrain data requirements, acquiring the data, and getting the data to the user extended beyond the M&S community. In the operational domain, the Army is faced by similar terrain data challenges that face M&S. The quest for digitization and increased situational awareness make paper maps and associated terrain analysis products undesirable. Furthermore, the multiplicity of agencies trying to define terrain data requirements, data format, data sources, and data management and distribution was as prevalent as in M&S. Clearly, we concluded, there was an urgent need for a unifying agent in the digital terrain data field and this led to the formation of the TRADOC Program Integration Office for Terrain Data (TPIO-TD).

Tackling challenges

TRADOC quickly approved the initiative and the U.S. Army Engineer School appointed an Interim TPIO-TD to begin tackling the terrain data challenges facing the Army. The initial mission for TPIO-TD was to "coordinate and synchronize all Army digital terrain data requirements for current operations (including distribution), combat developments, training, and models and simulation." Over the intervening

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months since the formation of the TPIO-TD, the mission has grown to include responsibility for the terrain analysis/terrain evaluation functionality that must be embedded within the Army's Battle Command System (ABCS).

To accomplish the expanded mission, at least for the operational portion, the TPIO-TD has developed four separate, though related, objectives that must be accomplished. The first objective is to establish the Army's requirements document for all topographic data. This includes the requirements for imagery, maps, Digital Terrain Elevation Data (DTED) and terrain feature data (roads, bridges, soils, etc.). Once the end-state requirements are established, the TPIO will ensure they are integrated with other service requirements into a joint requirement for the National Imagery and Mapping Agency (NIMA).

Identifying capabilities

Working within TRADOC, especially with TPIO-ABCS, the efforts began to identify those capabilities that must reside within the various models, simulations, information systems, fire control systems, and maneuver control systems needed to allow the terrain visualization process. This will define what terrain analysis/terrain evaluation functionalities must be common to all systems, the Common Terrain Operating Environment (CTOE), and which additional functions are required by individual systems. The CTOE will form the basis of the Army's functional requirement for the Joint Mapping Tool Kit (JMTK) to ensure interoperability in the joint environment.

Once the CTOE is established, the TPIO-TD will begin working toward the third objective, bringing each individual system into compliance with the CTOE. Working very closely with TPIO-ABCS and the various TRADOC Systems Managers (TSM), TPIO-TD will develop the migration plan for each system to become compatible in the CTOE. This will become a continuing part of the TPIO's mission since, as systems undergo further development, they will require recertification of their compliance within the CTOE to ensure that interoperability does not diminish over time.

Finally, the fourth objective is to define how digital topographic data distribution will occur within the operational forces. The distribution concept will actually address more than mere distribution. It also will include definition of the process for data base updates and enrichment once the force is deployed. Further, the concept will identify the responsible agent for terrain data base management to include maintaining fidelity of the data base. Acceptance of the concept as the Army's solution to the digital topographic data distribution and management challenge will most likely produce significant doctrine, training, leader development, organizational, and material (DTLOM) impacts for the Army Engineer community.

The director of the newly activated Maneuver Support Battle Lab (MSBL), Col. Ed Arnold, was designated as Interim TPIO-TD and work has begun in pursuit of each of the four aforementioned objectives. Since TRADOC has not yet provided resources to the effort, the Engineer School Director of Combat Developments has provided David Lueck from the Terrain Visualization Center to assist in the process. The MSBL also is supporting TPIO's effort with Capt. Gerrie Gage. Additionally, the U.S. Army Topographic Engineering Center, Alexandria, Va., is providing much-needed technical assistance and a Technical Liaison to the TPIO-TD. The first TPIO-TD is set to be selected by fiscal year 1998, Colonel-level Command Selection Board and could, possibly, be in place at Fort Leonard Wood, Mo., in late summer 1998.

It is clearly our responsibility to be the masters of terrain. This continues to take on greater significance as we move forward in this Information Age Frontier. As the Topographer of the Army, I look for the TPIO-TD effort to map the path to Force XXI. It is a formidable task with many obstacles. We are up to the challenge and always the terrain experts. (Maj. Gen. Clair F. Gill, Commandant, U.S. Army Engineer School, Fort Leonard Wood, MO 65473)

What are your GI area requirements?

What is geospatial information (GI)? GI is the new terminology used to describe both hard copy, and digital topographic information and products. GI replaces the term Mapping, Charting and Geodesy (MC&G).

Do you need GI to support the development or testing of a system, to participate in an exercise or training mission, or to perform software development? If so, you need to be concerned with how you are going to get the GI to support your mission. If the GI are available from the National Imagery and Mapping Agency (NIMA), you must submit a request to the NIMA Combat Support Center. If the GI are unavailable from NIMA, you must state a requirement for the GI. A request is placing an order for available GI from NIMA. A requirement is the way to tell NIMA what GI you need produced.

Your first step is to determine if the GI is indeed available. There are several NIMA publications available to assist you in identifying available GI. These documents include: NIMAL 805-1A, "NIMA GGI&S List of Products and Services;" NIMA publication, "Digitizing the Future;" NIMA Catalog Part 3, "Topographic Products," Volumes 1 and 2; NIMA Catalog Part 4, "Target Materials," Volumes 1 and 3; and NIMA Catalog Part 7, "Digital Data Products," Volumes 1-3. Other catalogs which may be useful are identified in NIMAL 805-1A. In addition, NIMA has liaisons at each of the CINC's, at the U.S. Army Special Operations Command (USASOC) at Fort Leavenworth, Mo., and Fort Hood, Texas.

Requests for GI

If you are a member of an Army field unit, your request for paper maps and charts is handled through the normal Army supply channels. If your system downloads digital GI from NIMA distribution media, place your order for GI directly to NIMA's Customer Support Center (CSC). Eventually, even digital GI stored on media, such as Compact Disc-Read Only Memory will be requested through the normal supply channels. If your system uses GI that is from NIMA but provided by another organization because the data may be reformatted, combined with other data or provided on a different media (e.g. M/O disk), you must go to that organization to get your GI.

Supporting emerging crisis

If you need assistance in determining your GI needs or you need GI to support an emerging crisis, there are several avenues of help. The first is to contact your local topographic unit. If none exists, or they are unable to help, you may be able to elevate your request for help as high as Corps-level topographic units. These Corps-level units are the 29th Engineer Battalion at Fort Shafter, Hawaii, the 320th Engineer Company in Schwetzingen, Germany, and the 30th Engineer Battalion at Fort Bragg, N.C.

The next avenue for help is to contact the NIMA liaison that supports your respective CINC. If you are unable to identify the appropriate NIMA liaison, contact the NIMA Army Customer Support Team at 703-264-3001 (DSN 570-3001), and they will get you in touch with the appropriate NIMA liaison.

If you are not a member of an Army field unit, you should request GI directly from NIMA's CSC. The center ships all GI to the Department of Defense Account Activity Code (DODAAC) address designated for your unit or activity, and you must have a valid DODAAC number with a current shipping address to receive GI. If you need assistance related to your DODAAC number, you may contact the NIMA CSC at 1-800-826-0342, 301-227-2498 or DSN 287-2495.

Area requirements

If the GI you need is unavailable, you must go through the process of establishing a requirement for the GI. This process is described in Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3901.01, "Geospatial Information and Services." If possible, you should strongly consider moving the site of your exercise, system test or software development test, to a location where data are available. If you cannot move the site, you should understand that there is no guarantee that your requirement will be produced, or will be produced in a timely manner. Therefore it is critical that area requirements for GI be identified very early in the planning process for tests or exercises.

If you are a member of an Army field unit, you must work with the command MC&G Officer to ensure that your area requirements are properly stated in your respective CINC's area requirements submission. Refer to CJCSI 3901.01 for further details.

If you are not a member of an Army field unit, you will send your area requirements to the Office of the Deputy Chief of Staff for Intelligence (ODCSINT). The GI Team at ODCSINT will validate your area requirements and include them in the Army Service area requirements submission. There are two processes for submitting your area requirements to ODCSINT. The first is to respond to the ODCSINT area requirements call. Once a year, the ODCSINT GI Team will send out a message or a memo asking you to submit your area requirements. Your response to this call should include

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all known area requirements regardless of the year required. The second is to send your area requirements to ODCSINT as these requirements emerge. Although the second process is designed to support critical short-fuse area requirements, you may submit any area requirements in this manner.

The Digital Concepts and Analysis Center (DCAC) actively supports ODCSINT in the collection of area requirements from the modeling and simulation (M&S) and the research, development, test and evaluation (RDT&E) communities. We collect these area requirements by calling and/or visiting the many action officers of these communities.

TRADOC submissions

If you are a component of the U.S. Army Training and Doctrine Command (TRADOC), you submit your area requirements to TRADOC Program Integration Office (TPIO)-Terrain. TPIO-Terrain validates these requirements and forwards them to ODCSINT for inclusion in the Army Service area requirements submission.

If you are a member of a Forces Command (FORSCOM) unit, activity or installation, you are in a unique situation in that some of your area requirements can be listed as a FORSCOM CINC requirement and as an Army Service requirement. Your primary effort should be to work through the FORSCOM chain of command to get your area requirements stated in the FORSCOM area requirements submission. You also may submit your area requirements to TRADOC and/or ODCSINT for possible inclusion in the Army service area requirements submission. If you are a member of a National Guard or an Army Reserve unit, you must work your area requirements through your respective chains of command to ODCSINT.

Regardless, whether you are in an active, Guard or Reserve unit, or whether you are a member of the TRADOC, M&S or RDT&E community, DCAC is on call to help you understand and identify your functional and area requirements. We work with TPIO-Terrain to help identify Army's functional requirements for emerging high-resolution elevation, feature and imagery-based GI. We also help TPIO-Terrain identify approved software applications for exploiting these GI. We help the TRADOC centers understand and properly state in their material acquisition documents, the type of GI support required for the system. We work with the M&S community to help them understand and use existing GI and to identify functional requirements for higher-resolution GI. We work with system developers to help them understand GI and how to properly state GI functionality in their contractual documents. After contract award, we work with the developers and their contractors to help them understand the availability and uses of GI and GI exploitation software. We are available to come to your site and provide a comprehensive briefing and demonstration of the status and direction of GI and GI exploitation. We will tailor these "MAP DAYS" to suit your particular needs or interests. If you wish to schedule a Map Day or if you have questions regarding the availability and use of GI, contact us.

For more information, contact James Allen, U.S. Army Topographic Engineering Center, CETEC-PD-DR, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-9173, 703-428-9173 or jallen@tec.army.mil.

DTD issues and strategies for technical solutions identified in requirements study

In May 1995, the U.S. Army Topographic Engineering Center's (TEC) Digital Concepts and Analysis Center (DCAC) launched a study of digital topographic data (DTD) issues that affect the generation of Synthetic Environment (SE) terrain data bases. Funding for the study was provided by the Defense Modeling and Simulation Office (DMSO) through the Department of Defense Modeling and Simulation Executive Agent for Terrain, the Terrain Modeling Project Office (TMPO), National Imagery and Mapping Agency (NIMA). This article highlights key DTD issues that were revealed in the study and identifies some of the strategizing that has occurred for finding technical solutions to them.

Four systems were investigated for the study: TEC's Digital Products Center's (DPC) Terrain Data Base Generation System; Project Manager for Combined Arms Tactical Trainers (PM-CATT) Close Combat Tactical Trainer (CCTT); U.S. Air Force 58th Training Support Squadron's Mission Training Support System (MTSS); and the U.S. Special Operations Command's (USSOCOM) Special Operations Forces Aircrew Training System (SOF ATS). The DPC system is a data base generator only; whereas the three training systems (the CCTT, MTSS, and SOF ATS) each have their own Data Base Genera-

tion Systems (DBGS). The first two of these systems produce terrain data bases to support Army ground-vehicle simulation exercises, while the latter two produce terrain data bases for U.S. Air Force and USSOCOM helicopter and aircrew training, and mission rehearsal.

Exploiting standard DTD

All four of these systems exploit standard DTD products, primarily Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAD), and Interim Terrain Data (ITD). Supplemental data are ingested from a variety of imagery, cartographic, and other miscellaneous data sources. Each of these systems uses a different representation of the terrain surface with their own sets of software tools, and produce run-time data bases for various types of image generators, which support different polygonal representations of the synthetic environment.

Interviews with the DBGS operators of the four systems led to the identification of five critical data base generation roadblocks that stem from the use of current DTD products as inputs to the data base generation process, as follows. First, the general unavailability of standard high-resolution DTD is a challenge faced by all SE terrain data base developers. As a result, the DBGS are forced to accept a variety of alternative data sources that have unique data elements, data structures and formats which, in turn, complicate the development of front-end, data input components.

Second, DBGS developers devote significant resources to correcting and eliminating consistency problems with data sets, such as poorly formed features, elevation anomalies, and inconsistencies across cell boundaries. Third, DBGS developers expend considerable resources in attempting to integrate terrain elevation data and two-dimensional feature information to create a realistic three-dimensional representation of the terrain. Fourth, developers require a single feature layer representing the appearance of the terrain. The multiple thematic feature layers currently being used cause correlation problems in separately produced thematic layers creating additional editing work for the DBGS operator. And fifth, both the existing and prototype DTD products do not have all of the geometric and attribute information required to support synthetic environment generation. For example, data element conflicts arise where more than one elevation value is required at a single location where there is a convergence of multiple features, such as bridges, overpasses, and tunnels, making it difficult to achieve connectivity of those features at that location. In addition, each feature must contain enough attribution about its surface material composition to support the reconstruction of the feature as a three-dimensional object.

The study serves as an educational tool for the SE community . . .

Complexities

The five problems discussed above illustrate the complexities of exploiting DTD for SE applications. These problems defy easy solution; further work is needed. Clearly, characteristics of DTD that are most important in the creation of SE data bases must be defined. This has not yet been accomplished. Also, the development of extensions to the Vector Product Format (VPF) standard will have to be addressed. Candidate extensions to VPF include the integration of terrain elevation information and three-dimensional feature information, and support for a standard baseline representation of the terrain surface and three-dimensional features.

The study serves as an educational tool for the SE community and is intended to foster understanding of the DTD issues and problems that affect the generation of SE terrain data bases. DCAC is working with the appropriate members of the SE community and NIMA to promote awareness of SE-specific data base generation issues and work toward the development of standard DTD solutions.

The executive summary for TEC Report No. 0091, titled "Analysis of DTD Issues in support of SE Terrain Data Base Generation," November 1996, will be posted on the DCAC home page at www.tec.army.mil/PD/dcac/dcac.htm#top.

For more information, contact James Ackeret, U.S. Army Topographic Engineering Center, CETEC-PD-DR, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-9173, 703-428-9173 or jackeret@tec.army.mil.

Problems and solutions

TEC and NIMA work to interact hard-copy map grids and computer-based systems that use WGS 84

The ability to visualize terrain using digital terrain data (DTD) has taken on a heightened degree of importance. Split-based operations, Force XXI doctrine, the heightened pace of maneuver, and other demands have forced greater and greater reliance on artificial terrain data. Although commanders always prefer to walk the ground, DTD can project three-dimensional ground images, allow various types of simulations based on the actual area of operations, and support terrain-related operational analyses, such as cross-country mobility, weather effects on the terrain and line-of-sight analysis to name a few.

Leading way

The Army is on the leading edge of a digital mapping revolution. In development are data types and systems that support joint interoperability for simulations, terrain visualization, and terrain analysis functions. As these systems mature and data formats become standardized, they will transfer terrain data and operational instructions, in near-real-time, to every echelon. However, we are not at that stage yet, and still rely on paper maps, a situation not expected to change for some time.

The interaction of older paper maps and newer digital systems has caused some growing pains. One such issue became most prominent in Korea and at the Joint Readiness Training Center (JRTC). Both JRTC and U.S. forces in Korea found that coordinates derived from local paper maps differed significantly from coordinates derived from DTD for the same position. This coordinate mismatch was of a significant amount and required resolution.

The referencing of different datums by the paper maps and the DTD caused the problem. Before the development of the World Geodetic System of 1984 (WGS 84), paper maps were drawn based on a local or other worldwide datums. Paper maps drawn or revised after 1984 and all National Imagery and Mapping Agency (NIMA)-produced digital systems use WGS 84 exclusively, which eliminates coordinate shift from system to system. However, there are many NIMA-produced maps and charts, based on older datums.

Datums are points or levels of reference, often unique to each country or region, applied to mathematical models that most closely approximate the shape of the earth. The models most commonly used are oblate ellipsoids. Often named differently than the datums, newer ellipsoids often share the same name. WGS 84 is one such ellipsoid and merits further discussion.

UTM chosen for military

WGS 84 is a three-dimensional, earth-centered, earth-fixed ellipsoid of rotation that provides the basis for the WGS 84 datum. Although the ellipsoid itself has geographic coordinates, the Army needed a simplified rectangular coordinate system. The system chosen for military use was the Universal Transverse Mercator (UTM) coordinate system as referenced to the WGS 84 datum. Previous hard-copy (paper) maps also used the UTM coordinate system, but, referenced it to the reference datum that was in use at the time. Therefore, because of the different reference point, the coordinates will differ significantly. WGS 84 datum coordinates when compared with coordinates based on the WGS 1972 datum will commonly deviate more than 200 meters. NIMA is working to reprint and regrid all maps gridded on datums other than WGS 84. Until that lengthy process is completed, older sheets will still cover many areas.

The ideal situation is to have all terrain data and maps on the same datum. Until then, NIMA and the U.S. Army Topographic Engineering Center (TEC) have developed computer programs to transform coordinates from one datum to another. This method is accurate and requires little training; however, it is relatively slow.

Critical information

Soldiers must be trained to identify and recognize the datum information stated in the legend of the map. This information is critical to effective tactical communications. Also, radio operators must be trained to ask for the map-sheet reference datum. Unit standard operating procedures must be developed to convert coordinates from one datum to another. Not only will these methods alleviate datum mismatch problems, but, they will prove helpful during combined operations.

These recommendations are "work-arounds" and are not intended to be final solutions. Only the complete regridding of the affected map sheets can be considered the final solution. Until that time, these recommendations will allow safe and effective operations on systems that reference different datums. Both NIMA and TEC are available to help to ameliorate this potentially deadly situation.

For more information, contact Rick Ramsey, U.S. Army Topographic Engineering Center, CETEC-PD-DR, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-6758, 703-428-6758 or cramsey@tec.army.mil.

NIMA devises bold new strategy for geospatial products in information age

The Department of Defense (DOD) Geospatial Sciences community currently is experiencing times of unprecedented change. The men and women serving in our Armed Forces are now asked to support a wide variety of tactical missions that include peacekeeping, evacuations, drug interdiction, counter terrorist activities and coalition warfighting.

Mission preparation timelines are short, enemies may not be known in advance, and crisis situations can erupt in any number of globally distributed hot-spots. The hard-copy maps and charts that were used during the Cold War are no longer sufficient, by themselves, to support the *dynamic requirements* of our warfighters today. Also, we cannot afford to wait the lengthy timelines required for the production of complex standard digital products. There is a growing need for rapid access to current, accurate, high-resolution geospatial information in digital form.

Technological advances in the computing and telecommunications industries are making possible the instant acquisition and distribution of this information on a global scale. The paradigm has changed from an age of "just-in-case" cartographic products to one of "just-in-time" Geospatial Information.

Recommendations

In recognition of the need to bring the DOD into the 21st century, the Defense Science Board (DSB) recommended that its geospatial producing agencies:

- Evolve to a distributed heterogeneous Internet-like architecture that uses geospatial data bases as its foundation;
- Change the defense mapping mission to one that maintains the geospatial data bases and protects access and integrity;
- Institute a requirements process that prioritizes users geographic needs;
- Rapidly acquire access to virtual worldwide data bases using all available commercial, government and foreign sources and practices; and
- Equip and educate the end user to locally add value [to the geospatial data bases] to meet their needs. (Reference: GII Master Plan, Volume II, January 1997.)

Changing to keep pace

The National Imagery and Mapping Agency (NIMA) also has recognized that it must change to keep pace with rapidly advancing technology and evolving requirements of its customers. They now realize they must fundamentally change the way they acquire, generate, and deliver geospatial data. Current NIMA production systems and operations that have been primarily focused on the methodical production and delivery of high-quality maps, charts and standard digital data products on Compact Disc-Read Only Memory have resulted in traditional products that provide inadequate global coverage or don't meet the condensed timelines to support an operational mission.

NIMA has aggressively mobilized to investigate and implement ways of meeting the challenges presented by the *Geospatial Information Age* by initiating a $600 million, 8-year effort to build a new digital mapping infrastructure. Called the Geospatial Information Infrastructure (GII), its fundamental objective is to provide battlefield commanders with real-time geospatial information and services. The strategy for the GII is centered around the concept of *framework*.

NIMA defines Framework as:

"A trusted, consistent set of geospatial information and supporting services that provides a coherent frame of reference to support the formation of a common operational view (from the perspective of a user or producer)." (Reference: GII Master Plan, Volume II, January 1997.)

Cornerstone to the concept of Framework is the establishment of a baseline of foundation geospatial data to which NIMA and others (including the users of the data) can add more detailed, higher-resolution data. NIMA has defined **Foundation Data** and **Mission-Specific Data Sets (MSDS)** to satisfy this requirement.

Foundation Data will be an accurate, stable, near global baseline of geospatial information comprised of three major components: foundation feature data, geodetically controlled imagery, and elevation data. Specific information on each of these follows.

- Foundation Feature Data (FFD)-comprised of regionally significant features, which are organized into thematic coverages. FFD will use the Vector Product Format (VPF) and Feature Attribute Coding Catalog (FACC) conventions employed in other NIMA products (e.g., VMap) and will be derived from photogrammetric sources.

Note: The feature content of Foundation Feature Data is still being defined by NIMA, with input from DCAC and other Service representatives, and is likely to change (See Page 12.).

- Geodetically Controlled Imagery- near-global highly accurate digital monoscopic and stereoscopic imagery.
  - Controlled-Image Base (5- and 10-meter resolution)
  - Digital Point Positioning Data Base
- Elevation Data
  - Digital Terrain Elevation Data-Level 2

(Continued on page 12.)

Tentative feature content includes the following:

Coverage	Feature Content
Boundaries	Coastline/Shoreline, Maritime Limit Boundary, Administrative Boundary, Armistice Line, Cease-Fine Line, Control Point/Control Station, Named Location
Elevation	Depth Contour, Contour Line, Spot Elevation
Population	Built-up Area, Settlement, Native Settlement, Named Location
Surface Drainage	Settling Basin/Sludge Pond, Island, Water (except inland), Aqueduct, Canal, Ditch, Filtration Beds/Aeration Beds, Fish Hatchery/Fish Farm/Marine Farm, Lake/Pond, Land Subject to Inundation, Reservoir, River/Stream, Salt Evaporator, Dam/Weir, Lock, Named Location
Transportation	Railroad, Railroad Siding/Railroad Spur, Railroad Yard/Marshaling Yard, Cart Track, Road, Trail, Bridge/Overpass/Viaduct, Ferry Crossing, Tunnel, Ford, Airport/Airfield, Runway, Named Location

(Reference: Foundation Feature Data Associated Performance Specification, Jan. 9, 1997.)

Coverages and features that DCAC has requested NIMA consider for inclusion

Coverage	Feature Content
Industry	Tower
Obstacles	Bluff/Cliff/Escarpment
Utilities	Power Transmission Line
Vegetation	Barren Ground, Marsh/Swamp, Orchard/Plantation, Trees

Foundation data establishes the "trusted" reference for the registration and integration of other spatially and temporally tagged data. It is not tied to any specific mission or service requirement. Rather, it is intended to provide essential information for initial planning purposes. NIMA believes it is possible to produce and provide foundation data for 100 percent of the JCS Priority 1 and 2 areas by the year 2000.

Mission-Specific Data Sets will be requirements driven, feature enriched portions of the Foundation Feature Data. NIMA customers will articulate static (normal production) and dynamic (crisis production) requirements for additional feature data based on *specific mission needs*.

Static MSDSs will be comprised of standard thematic coverages with feature content similar, if not equivalent to, current NIMA products. Coverages will be made available as soon as they are completed, rather than waiting for the entire MSDS to be completed before it is released. For example, if the vegetation, obstacles, and utility coverages from DTOP are requested by a customer, these three coverages would be incrementally produced and delivered (accessible through the Internet-based *data warehouse* that is planned for the GII) as they are completed in the customer-specified order. Dynamic MSDSs will be comprised of highly tailored, custom coverages involving features collected from a variety of sources. NIMA believes it can produce and provide MSDS data for 40 percent ("just in case" concept) of the JCS Priority 1 and 2 areas by the year 2000. However, when necessary, the GII concept requires NIMA to harness the full resources of the Geospatial Information Age to bear on their production providing its customers with the best available data, in a real-time manner ("just in time" concept).

For more information on the GII, Framework, Foundation Feature Data, or Mission Specific Data Sets, contact NIMA through their Geospatial Information home page at http://164.214.2.57/ or contact David Baxter, U.S. Army Topographic Engineering Center, CETEC-PD-DS, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-6505, 703-428-6505 or dbaxter@tec.army.mil.

TEC joins OpenGIS Consortium

The U.S. Army Topographic Engineering Center (TEC) recently joined the OpenGIS Consortium (OGC). OGC was founded in August 1994 to provide a formal structure and process for the geographic information community to develop the OpenGIS™ concept into readily available technology. Today, OGC is an 80-plus membership organization (and growing), which includes key geographic information system (GIS) and computer product vendors, integrators, telecommunications development groups, data base developers, federal agencies, and universities, all focused on developing an open system approach to geoprocessing.

Varied membership

The National Imagery and Mapping Agency (NIMA), U.S. Geological Survey, National Conservation Resource Service, National Oceanographic and Atmospheric Administration, and other federal agencies are OGC members.

OpenGIS™ is defined as transparent access to heterogeneous geodata and geoprocessing resources in a networked environment. The OpenGIS™ concept grew in response to widespread recognition of the following needs:

- The users' need to integrate geographic information contained in heterogeneous data stores whose incompatible formats and data structures have prevented interoperability.
- The larger community's need for improved access to public and private geodata sources.
- Agency and vendors' need to develop standardized approaches for specification of geoprocessing requirements for information system procurement.
- The industry's need to incorporate geodata and geoprocessing resources into national information infrastructure initiatives, in order that these resources be found and used as easily as any other network-resident data and processing resources.
- Users' need to preserve the value of their legacy geoprocessing systems and legacy geodata, while incorporating new geoprocessing capabilities and geodata sources.

Accessible data

The goal of the OpenGIS™ Project is to develop a comprehensive open interface specification that defines a standard way for software to be written to access all types of geospatial data and a common set of geospatial services that function in a distributed (across a network), heterogeneous (multi-vendor GIS tools and data base formats) geoprocessing environment. To date, the OGC has created an abstract specification for OpenGIS™ and is in the process of creating detailed engineering-level OpenGIS™ specifications for specific, industry-accepted, distributed computing platforms (DCPs), such as OLE/COM, CORBA, and the Internet's http and Java standards.

Authentic labels

OGC trademarked the term "OpenGIS" to constrain the definition of OpenGIS™ so that vendors will be able to put authentic labels on OpenGIS™-compliant geodata access and distributed geoprocessing

(Continued on page 14.)

products. OGC "branding" of products will give users precise information about the kind and degree of interoperability these products afford.

There will be considerable benefits and impacts to the Army's geospatial community with the realization of OpenGIS™ technology. Opening up the interfaces between spatial tools and proprietary spatial data bases will promote competition and change GIS marketing strategies. The fight between GIS vendors will be brought down from the merchandizing of large monolithic GIS systems to the sale of interoperable geospatial component tools (GIS componentware) and choice of geospatially capable data base engines. No longer will the GIS consumer be limited to purchasing and using only one vendor's GIS system. Instead, the user will be able to use the best choice of vendor and government-developed spatial tools integrated together with the data base engine that is best suited to meet their mission. Also, geospatial technology can be better integrated into other Information Technologies (IT) so that geospatial information can become part of the corporate data base. In addition, direct access to geospatial data that can be stored on any system on the network (and in a variety of vendor proprietary data base formats) will reduce the amount of duplicate data base storage and maintenance and eliminate the need to translate or reformat data between systems.

As a technical member of the OGC, TEC will be representing the Army's requirements for geospatial technologies. TEC recognized that this forum provides the Army with a good opportunity to work with industry and other government organizations to jointly formalize requirements for new GIS technology and then allow industry to provide solutions.

Heavy investment

NIMA is investing heavily in OGC to help define and potentially solve many of the geospatial data base development and processing interests for their Geospatial Information Infrastructure (GII). NIMA has stood up a Geospatial Information Infrastructure/Integrated Product Team (GII IPT) to develop an initial operating capability to demonstrate the feasibility of implementing GII concepts. Through this GII IPT, NIMA has formed a "strategic" alliance with OGC requesting their assistance in defining requirements for the GII and to potentially provide commercial-off-the-shelf technology required to implement this GII concept.

The information provided was assembled from a selection of OGC documents and presentations. For more information about OpenGIS™ and OGC, visit their website at www.OpenGIS.org. For information about the Army's participation in OGC, contact Kevin Backe, U.S. Army Topographic Engineering Center, CETEC-PD-DS, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-6505, 703-428-6505 or kbacke@tec.army.mil.

GIS Corner

Roads are red and rivers are blue . . .

Columbo poured himself another cup of coffee as he waited for his eager new assistant to come into the office. He stared at Jerry's map, which was covered with blue forests, red streams and green highways. It didn't look like any map he had ever seen. Jerry popped his head in, "I hope you like my map!" Columbo sat back and slowly answered, "Jerry, this is . . . really different . . . but I'm not sure I understand it." Jerry quickly responded, "It's easy. I feel blue when I'm in the woods, so I colored them blue. Streams really run rapidly so they're red. And you go, go, go on highways, so they're green." Columbo sipped his coffee, sucked in his breath and said, "Jerry . . . let's talk about map design."

From Columbo and the Mixed Up Map

Introduction

Cartography (mapmaking) has been described as both an art and a science. Before World War II, the art in cartography dominated over the science. Since World War II, cartographers have been very concerned with the scientific side of maps. They have studied design choices and developed guidelines to help mapmakers create maps that effectively communicate. These guidelines consider the type of data being mapped, the choice of appropriate map symbols for the data, the importance of different map features, and the use of color, text, and overall map layout.

Tools for mapmaking are readily available today in desktop geographic information system packages, mapping packages, graphic design packages, or even spreadsheets. This has caused traditional cartographers to fret about the proliferation of poorly designed maps as their carefully obtained knowledge about design is ignored. However, a lack of formal cartographic education should not be a problem. You don't need to be a cartographer or take a cartography class to create well-designed maps. Introducing yourself to map design guidelines,

which are readily available, can instantly improve the quality of your maps.

Knowing your data

The mapping process begins with an understanding of the data to be mapped. Maps are not the real world, but simplified representations of the world. Real-world features are converted to point, line, or area symbols for display on a map. Some of the things we map have smooth transitions, like elevation, while others have sharp transitions, like laws which change at state boundaries.

Visual variables

Map symbols can be constructed using one or more of Jacques Bertin's visual variables. These include hue (color), value (darkness), size, shape, pattern, orientation, and others. For example, you can show classes of land use with different colors or temperature ranges with darkness of a single color. Bertin's original visual variables have been expanded and modified by later cartographers.

Choice of appropriate map symbol

Bertin had the notion that if the correct combination of symbol and map feature is selected, the brain will process the map symbol automatically to understand the intended relationship between the symbol and the real world. This reduces the amount of effort by the map reader in decoding the map and greatly increases the chance that the map will be correctly understood.

For example, the relative size of a circle could represent the population of a city. Larger circles would indicate cities with larger populations. You could have smaller circles indicate cities with larger populations, but this wouldn't make sense since we associate larger with more. You also could have cities shown by symbols of the same size in different colors. But this also would be a problem, because we associate different colors with different kinds of things, not with differences in the amount of a single thing.

Graphic hierarchy

A second major issue in map design is the creation of a graphic hierarchy. Some features on your map are more important than others and you want to direct the map reader's attention to them (have them higher in the hierarchy). Other features may be less important, so you may want them to be very subtle (have them lower in the hierarchy). Cartographers have borrowed a number of tips from artists for establishing a hierarchy of map features. These include such tricks as having important map symbols block less important map symbols or having important features in bright colors and less important features in dim colors.

Other considerations

Selecting the appropriate map symbols and establishing a graphic hierarchy is only part of the map design process. There are other important issues, such as the selection and placement of text, the use of color, and the overall organization and placement of map features on the screen or page.

Almost all modern cartography books describe the visual variables and graphic hierarchies, as well as color selection, text and map composition. Two excellent introductory sources are *some Truth with Maps: A Primer on Symbolization & Design,* by Alan M. MacEachren and *Mapping It Out: Expository Cartography for the Humanities and Social Sciences* by Mark Monmonier. (Douglas R. Caldwell, U.S. Army Topographic Engineering Center, CETEC-TD-TD, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-6775, 703-428-6775 or caldwell@tec.army.mil).

GIS Tips

Books: Bertin, Jacques. *Semiology of Graphics: Diagrams, Networks, Maps.* University of Wisconsin Press: Madison, Wisc., 1983

MacEachren, Alan M. *some Truth with Maps: A Primer on Symbolization & Design.* Association of American Geographers: Washington, D.C., 1994

Monmonier, Mark. *Mapping It Out: Expository Cartography for the Humanities and Social Sciences.* University of Chicago Press: Chicago, Ill., 1993

Web Sites

Cartographic Communication (Map Design/Visual Variables) http://www.utexas.edu/depts/grg/gcraft/notes/cartocom/toc.html

Color Use Guidelines for Mapping and Visualization http://www.gis.psu.edu/Brewer/CBColorHTML/CBColorTop.html

Making Maps Easy to Read http://acorn.educ.nottingham.ac.uk/ShellCent/maps/

VPFView Series:

Meeting the data base access challenge

Vector Product Format View (VPFView) is a National Imagery and Mapping Agency (NIMA)-produced browsing tool, which enables users to access and display any VPF data base, modify display symbology and tailor customized views to generate hard-copy or soft-copy graphical outputs. It also permits querying of individual features for attribute information. VPFView is not a Geographic Information System (GIS), and it does not permit any modification of positional or attribute information. Its primary function is for evaluation.

VPFView software is distributed with most VPF prototype and production data bases, and its wide dissemination has generated significant interest and some confusion with regard to its operation. The intent of this first article in the VPFView series is to provide general information with regard to initial data base access and dispel any apprehension that potential users may have.

Because VPFView permits custom tailoring of VPF data bases and symbology, linkages to these items must be established prior to viewing the data for the first time. A common user complaint is that too many steps are required to install and view the data. The user has the ability to choose from various data base locations (Compact Disk-Read Only Memory (CD-ROM) or hard disk), define custom symbology (from the many different available symbol libraries) and access an assortment of data libraries (many of which are coincidentally named). All of these parameters must be defined at the initial stage. An understanding of these prerequisites will enable users to realize VPFView's flexibility in order to successfully exploit the many different possible scenarios with regard to data base access.

Software evolution

Initial VPF prototypes were distributed with VPFView software that configured the data base and symbology linkages automatically upon installation. Although installation was straightforward, users held the common misconception that VPFView software was data base specific, and they installed a different version of the software for every data base accordingly. In later releases, NIMA stopped developing customized installation scripts for every data base. Instead, users must now define the data base access parameters. Though more challenging, this change empowered users with the ability to access multiple data bases and symbol libraries from a single version of the software. In order to achieve this, a certain level of responsibility was placed on the user to understand the basic VPF data structure and software architecture. Although basic installation instructions are provided with *readme* files, little explanation is provided about the data base access mechanics. Thus, most users find the VPFView installation process confusing.

Basic VPF structure

In order to successfully access a VPF data base, it is necessary to develop a basic understanding of the VPF data structure and VPFView software architecture. All VPF data bases are structured hierarchically in the following manner:
database\library\coverage\tile\feature_class\feature\attribute\attribute_value, where *database\library\coverage\tile* represents the directory structure. The top level of the VPF data base structure contains a *lat* file, a *dht* file, and at least one library directory. The significance of this is that VPFView prompts the user to locate the *lat* or *dht* file as a way of identifying the desired data base which may be one of many on a CD-ROM or hard disk.

View structure

In order to access a data base, VPFView relies on the concept of a **View**, which is simply a directory containing pointers to the data base. The pointers are ASCII text files (*env*, *themes* and *default.sym*) that define the tailorable parameters according to which the VPF data base is exploited. The name of a View ends in a percent symbol (%). An "installable" View must reside on the hard disk and be write-enabled. Most VPF data bases are distributed with predefined Views that accurately and specifically define symbology and themes (individually displayable feature/symbol combinations). In order to use a predefined View, it must be copied to the hard-disk, renamed from <name_> to <name%>, write enabled and installed. **Caveat**: If a VPF data base is not distributed with predefined Views (i.e., production VITD), a View must be created. It is suggested that predefined views always be used if available because the View Creation process assigns default (blank) symbology and very generic themes.

Symbol library

Another vital component of the data base access procedure is the definition of a symbol library. By default, VPFView software includes an XBitmap symbol library in a directory called <installation directory>\symbols. The directory contains four *.sym* "symbol set files" called *areas.sym*, *lines.sym*, *markers.sym* and *text.sym*. Individual data bases, however, are distributed with slightly different symbol libraries because of differences in feature content. Though it is

unnecessary to reinstall VPFView for every additional data base, use of any provided symbol library is recommended. This is significant because VPFView prompts the user to identify a “symbol set file” as a means of identifying the appropriate symbol library. This capability is pertinent if various data base specific symbol libraries are archived for access. **Caveat**: If VPFView software is not distributed with a VPF data base, there will not be an available data base specific symbol library. Another symbol library will have to be used, and subsequent feature/symbol linkages may not be correctly defined. Also, the VPFView software and symbology distributed on CD-ROM may be in a compressed form (a single installation file). If this is the case, it is necessary to install the software temporarily in order to access and extract the symbol library.

Installing a predefined view

If a predefined view is distributed with a VPF data base, the following instructions can be used to correctly access the data base using VPFView **Version 2.1: 1**) Locate the *views* directory on the CD-ROM. For a single VPF data base, this is typically located directly below “root” (i.e. d:\views). Inside the *views* directory will be one or more Views. A View will usually have an intuitive name (i.e. *havana_* or *meds_*) that ends in an underscore_. For a sampler CD-ROM containing multiple VPF data bases, Views may be more deeply nested (HINT: perform a search on the *env* or *themes* files). Using File Manager or a command prompt, copy the entire View directory to a logical location on the hard-disk. **2**) Once on the hard disk, rename the view with an ending percent symbol (%) rather than an underscore (_). Views can be moved or renamed at any time without affecting functionality. **3**) Using File Manager/File/Properties or a command prompt (attrib -r /s), change the properties of the files inside the View to enable write permission. **4**) Locate the symbol library on the CD-ROM (HINT: perform a search on *.sym). Copy the entire directory to a logical location on the hard disk and rename the directory to something intuitive (i.e., dnc or vmap0). (WARNING: If there is no available symbol library, but there is a VPFView installation script, install the software to a temporary location on the hard disk and copy the symbol library from there, then delete the software). **5**) From the VPFView interface, select File/View/Install. A “File Overwrite Warning” will prompt the user for an acknowledgment. **6**) Locate and select the *env* file for the View to install. This is located on the hard disk in the View directory that was just renamed. **7**) An “Install View Configuration” window will pop up. The name of the specified data base will be listed with an asterisk next to it. The data base location must be confirmed by pressing the “Modify Database Path” button. Locate and select either the *dht* or the *lat* file in the top level directory of the VPF data base (WARNING: there will already be an incorrect path defined). The VPF data base will be on the CD-ROM unless it was installed on the hard disk (HINT: hard disk installation is recommended as many VPF data bases are not very large, and performance is greatly enhanced). **8**) The asterisk next to the VPF data base name within the “Install View Configuration” window will disappear. Press the “Install” button. **9**) Locate and select any one of the four symbol set (*.sym) files from the data base specific symbol library that was extracted from the VPFView software on the CD-ROM. **10**) Select “Load” to load the data base or “Cancel” to install another View. Once the data base is loaded, review the symbols within the “Feature Selection Window” and ensure that they are logical. If not, they can be modified by clicking on the individual symbol to invoke a symbol editor. **11**) Select features for display from within the “Feature Selection Window.” Feel free to experiment as the VPF data cannot possibly be corrupted by the VPFView Software.

Creating a view

If a predefined view is not distributed with a VPF data base, it is necessary to create a view from scratch.

1) From the VPFView **Version 2.1** interface, select File/View/Cre-

(Continued on page 18.)

Photo #2

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4 7/16 x 3 3/8

3 3/4 x 2 7/8

118%

VPFView serves as a useful tool in NIMA data base software evaluations.

ate. **2**) Within the "Create View" window, select the ADD button. Locate and select either the *dht* or the *lat* file from the desired VPF data base. All available libraries will automatically be selected. Individual libraries may be deselected, though that is not recommended. Multiple data bases also may be selected. Press the "Create" button. **3**) Select one of the four "symbol set files" from any available symbol library and press the "open" button (NOTE: If a CD-ROM is not distributed with predefined views, it probably will not be distributed with VPFView software from which to extract a symbol library). **4**) Select a View path and file name. Press the "save" button. A percent symbol (%) will be appended to the name if not specified initially. The new View will automatically be loaded. **5**) Once the data base is loaded, the symbols within the "Feature Selection Window" will have to be changed from defaults (solid black) to logical symbols. This is done by clicking on the individual symbol to invoke a symbol editor.

Version differences

Within the last 2 years, only VPFView Version 2.0 has been distributed with VPF data bases. A better understanding of the VPF data structure and software architecture is required to use this version. Rather than locating the *env*, *dht* or *lat*, and a *.sym* file, the user is simply prompted to locate the View, the VPF data base, and the symbol set, respectively. Though View Installation using Version 2.1 has more steps, it is essentially foolproof. It is actually recommended to have both Version 2.0 and Version 2.1 installed. Because of a compatibility problem with Version 2.1, only Version 2.0 can install Views for certain isolated VPF data bases (i.e. VMap0 Disk 4). Additionally, only Version 2.0 can upgrade legacy Version 1.1 Views.

Availability

VPFView version 2.1 is available from NIMA as an independent module on the Mapping, Charting and Geodesy Utilities Software Environment (MUSE) CD-ROM. MUSE is a collection of independent geospatial data exploitation modules developed by NIMA and other independent government producers. MUSE modules include VPFView, Raster and Vector Importers, Raster/Vector Fusion, Datum Conversion and Coordinate Transformation, Line of Sight, Perspective Scene and Real-time GPS. The MUSE CD-ROM includes adequate "User's Guide" documentation and software source code. VPFView also is available as a standalone module that is individually downloadable from NIMA's MUSE 2.0 distribution site (http://www.nima.mil/DMAMUSE2). This site is password protected. E-Mail NIMA at MUSE@nima.mil to obtain a password or order a MUSE 2.0 CD-ROM. Additionally, a "Helpful Hints Guide to VPFView View Creation and Installation" will soon be available on the Digital Concepts and Analysis Center's (DCAC) web site (http://www.tec.army.mil/PD/dcac/dcac.htm).

Next in VPFView Series

The next article, Strategies for Optimizing Graphical Displays, will offer hints on how to maximize the VPFView display capability with regard to feature density, resolution and feature selection. (Cliff Jordan, U.S. Army Topographic Engineering Center, CETEC-PD-DT, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-6748, 703-428-6748 or cjordan@tec.army.mil)

DTD Technical Exchange Meeting set for Sept. 16-17, 1997

The U.S. Army Topographic Engineering Center's (TEC), Digital Concepts and Analysis Center (DCAC), is sponsoring a Technical Exchange Meeting (TEM) on Sept. 16-17, 1997, at the Humphreys Engineer Center's Casey Building (Bldg 2594), Alexandria, Va. If you are a current user of Digital Topographic Data (DTD) or plan to use it in the future, this is your opportunity to find out the latest information concerning important topics, such as the status of current and future land combat products, standard application software, and various modeling and simulation issues.

The first day of the TEM is usually reserved for tutorials/workshops and/or user presentations. On the second day, DCAC will host a variety of technical presentations intended to bring users up to speed on new product developments and applications, as well as other DTD topics of interest to the user community.

In addition to the aforementioned presentations, DCAC's Digital Data Demonstration System (D^3S) will provide demonstrations of various DTD products/prototypes, including Compressed Raster Graphics (CRG), Compressed ARC Digitized Raster Graphics (CADRG), Interim Terrain Data (ITD), Digital Terrain Elevation Data (DTED), Tactical Terrain Data (TTD), Vector Smart Map (VMAP) and Urban Vector Smart Map (UVMAP).

If you have ideas for workshops or special topics you would like to see presented, or are just interested in attending, please contact DCAC by July 1, 1997. Point of Contact at TEC is Louis A. Fatale, CETEC-PD-DT, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-6760, 703-428-6760, telefax, 703-428-6991 or lfatale@tec.army.mil.

DCAC completes Interim Terrain Data accuracy study

In 1996, the Digital Concepts and Analysis Center (DCAC) completed work on an in-house study to evaluate the positional accuracy of Interim Terrain Data (ITD). Because of the interim nature of ITD, as well as the many sources used to produce it, the National Imagery and Mapping Agency (NIMA) characterizes ITD accuracy as"TBD depending upon production system." With sizeable production of Tactical Terrain Data (TTD) still many years off, using ITD will continue for the foreseeable future. Consequently, DCAC set out to evaluate current ITD accuracy (photo vs. carto-controlled) over several continental United States (CONUS) locations.

The first phase of the study began in September 1994. Digital and hard-copy source data were reviewed and prepared for subsequent Geographic Information System (GIS) analysis. The second phase of the study involved field data collection. More than 400 features from selected ITD thematic layers (such as transportation, obstacles, vegetation and surface drainage) were visited. Using a Precision Lightweight Global Positioning System Receiver (PLGR) in the Precise Positioning Service mode (real-time absolute, ~10 meter horizontal accuracy), coordinates for the preselected ITD features were collected in the field. These field coordinates were then compared to coinciding digital ITD coordinates and their accuracy assessed.

The offset of the ITD features taken as a whole was approximately 25 meters. More than 90 percent of these features were within 50 meters of their expected locations. This meets the accuracy specification of a Class B 1:50,000-scale Topographic Line Map, a traditional source for targeting information. Carto-controlled ITD feature offsets (29 meters) were higher than photo-controlled ITD feature offsets (14 meters). The photo-controlled ITD was expected to outperform the carto-controlled data; however, the carto-controlled ITD was more accurate than anticipated.

DCAC's point of contact is Louis A. Fatale, U.S. Army Topographic Engineering Center, CETEC-PD-DT, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-6760, 703-428-6760, telefax 703-428-6991 or lfatale@tec.army.mil.

NIMA prototype evaluation SOP to provide better communications with GI&S user community

The Digital Concepts and Analysis Center (DCAC) has developed and implemented a Standard Operating Procedure (SOP) for prototype evaluations. The purpose of the SOP is to provide formal, structured guidance and information on procedures for the receipt, distribution, evaluation and consolidation of comments for Geospatial Information and Software (GI&S) prototypes developed by the National Imagery and Mapping Agency (NIMA). The intent of the SOP is to provide a better architecture for communicating NIMA initiatives to Army users and, conversely, to ensure effective communication of program requirements back to NIMA.

As DCAC relies on input from Army users to effectively communicate requirements, a stringently defined prototype evaluation procedure is warranted. User participation has declined in recent years due to many circumstances. This SOP was developed partly in an attempt to educate and energize the user to participate in this iterative process. Examples of NIMA prototypes include:

- Product suites, such as Vector Smart Map (VMap), which encompass several products,
- Individual products, such as Digital Topographic Data (DTOP),
- Production concepts, such as Vector Product Format (VPF) Database Update (VDU),
- Prototypes of data content and format standards, such as Feature Attribute Coding Catalog (FACC), Vector Product Format (VPF), or VPF Symbology (VPFS), and
- Prototype Software, such as VPFView.

If your organization has an interest in evaluating any of these types of prototypes in the future, contact Cliff Jordan, U.S. Army Topographic Engineering Center, CETEC-PD-DT, 7701 Telegraph Road, Alexandria, VA 22315-3864, DSN 328-6748, 703-428-6748 or cjordan@tec.army.mil.

Sense of humor, variety of jobs makes DCAC

When you first meet Kathy Ebersole, you'd never imagine that she occasionally spends her free time "Sitting on top of a big Harley." But, that is exactly what the bubbly, family-oriented, computer specialist in the Digital Concepts and Analysis Center's (DCAC) Requirements Division does. Along with husband Dave and 2 1/2-year-old daughter Kathreya, Kathy and a group of friends ride the big motorcycles to benefit various charities. "It's strictly a family-type atmosphere," she explained. "The husbands, wives and kids get together to have a good time riding. At the same time, we do something worthwhile to help charitable organizations. We're nothing like the people in the biker movies," she laughed.

An Army "brat," Kathy was born in Thailand, where her Army father met her mother, a Thai native. At the age of 3, Kathy came to the United States for the first time. During her father's military career, she and older brother Robert traveled back and forth between the United States and Thailand, which was her father's home base. When stationed in the states, the family lived mainly in the Northern Virginia and Maryland areas. It was during her time in the states that she met her husband Dave. "We lived across the street from each other and dated throughout high school. I married my lifetime partner," Kathy said.

Leaving the nest

Following graduation, Dave enlisted in the Navy and shipped out to his duty assignment in Groton, Conn. When Kathy graduated from high school 1 1/2 years later, she joined him in Groton. "I broke my mother's heart by moving because we're very close," Kathy said. After arriving in Groton, she decided to continue her education and enrolled in Mohegan Community College in Norwich, Conn. One year later, the couple married, and the following year, Kathy left college to "explore the job market in Groton."

For someone so people-oriented, Kathy's first job as a machinist seems odd, but she explained, "It didn't take too long for me to realize that being a machinist, making turbine blades for jet engines, was not the career I wanted," she laughed. "At the time, I made good money for the Groton area. But, I decided that sticking my hands in oil for long

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During Bring your Daughters and Sons to Work Day, Kathy demonstrated a mapping exercise to Eric Poulsen, Jason Kenawell, Sara Shepherd and Jessica Kenawell. (Photo by Wayne Marbury.)

periods of time was not going to work for me," she said. Another drawback to this job was that she couldn't wear her wedding rings.

Kathy's next venture into the job market was with a well-established film processing company, where, she said, she was content, happy, and actually enjoyed many segments of the job. "For several years, working in the film development section was rewarding and gratifying. It was fun and it was better than being a waitress," she explained.

Joining the government

After reading a newspaper ad seeking civil service applicants, and at the urging of her stepmother, Kathy took the civil service test and accepted a position as a part-time clerk in the Civilian Personnel Office of the U.S. Naval Underwater System Center in New London, Conn. "This position was better than making turbine blades or putting my hands in film chemicals but, it still wasn't what I wanted," Kathy said.

A year later, she joined the U.S. Naval Submarine Base in Groton as a telecommunications operator in the message center. It was during this time that she and Dave had to make a major decision concerning their future—whether or not he should remain in the Navy. "We decided that if we were going to have a family, Dave needed to leave the military," Kathy said. "I never saw him 6 months out of the year. He asked if it was OK to get out, and I said yes," she said. One year prior to his final tour of duty, she relocated to Virginia where her mother and stepfather live and "where the higher paying jobs are," she said.

Although her family had lived in the area when she was a youngster, Kathy was still unfamiliar with the area and accepted a job as a telecommunications operator in a government agency, which required a major commute on the infamous Beltway. Unknown to her, she also was being sought by the Concepts and Analysis Division (now DCAC) for an interview as a secretary in the then-Requirements Branch.

"My stepfather was familiar with TEC's (then ETL) reputation and recommended it as a good place to work. So, I declined the telecommunications position," she said. When Kathy joined DCAC in 1989, she discovered that her boss had a good sense of humor. "After I accepted the position, my boss told me that what really sealed my selection for the secretarial position was that he considered me to be a Maryland person (having lived in Hagerstown, Md., for many years), and I had worked at the film processing company where he sent his film," she joked.

After more than 2 years of performing secretarial duties, Kathy began taking computer programming classes and completed the Computer Programming Diploma Course. "At that time, I was ready to move on to something more interesting and I let that fact be known," she said. Fortunately for her, a computer specialist position opened in the branch, but she still had to compete with several candidates, including one who also had completed the diploma course. "I think my edge in the competition was that in addition to my secretarial duties, I had performed some of the same programming functions that the job required," she explained.

All business

Although she frequently jokes with co-workers, Kathy is all business when it comes to her work as the data base manager for the division. In this capacity, she provides technical support to DCAC by developing, maintaining and upgrading the content, structure and user interfaces of digital data bases. She also is responsible for the maintenance and upgrading of other software tools which are used to track technical information on digital topographic data (DTD) and user requirements for DTD within the Army.

"Customer service is a top priority within and outside DCAC," Kathy said. In her present position, she works closely with representatives from the Office of the Deputy Chief of Staff for Intelligence, U.S. Army Training and Doctrine Command Program Integration Office for Terrain Data, Engineer School, and the National Imagery and Mapping Agency (NIMA).

Currently, she participates on a team made up of other members of DCAC's requirements division and representatives from NIMA, who are developing the Army Geospatial Information (GI) Requirements Data Base. GI (a term formerly known as mapping, charting and geodesy) is used to describe both hard copy and digital topographic information and products. "Right now, the team is looking at the structure of the data base and determining what elements it will be required to query. Our goal is to reach initial operational capability by the end of this fiscal year," she explained. When the data base is completed, it will be available on the Internet.

Kathy's goals for the future include completing her bachelor's degree in computer information systems technology, and adding a brother or sister to the family. She also says she will continue to hit the road to help others. So, the next time you hear the roar of a big motorcycle, check to see if Kathy is "Sitting on top of that big Harley."

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